Borderline™

Owner's Manual

SEGA®/Gremlin®

Manual Part No.
420-0613

Borderline™

OPERATING INSTRUCTIONS

AND

SERVICE MANUAL

MANUFACTURED BY

SEGA/GREMLIN
TLX 910-335-1621

INTRODUCTION

BORDERLINE is an electronic game that makes extensive use of digital integrated circuitry and television monitor concepts. This manual is designed for the maintenance technician who possesses a general knowledge of solid state circuitry, microprocessor and digital integrated circuitry and TV monitor concepts. Any individual not knowledgeable in these areas should not attempt repair of the electronic portion of the game. If you have any questions not answered in this manual, call SEGA/Gremlin Customer Service, 800-854-1098.

GAME SET-UP AND INSPECTION

1. Inspection

Before pluggging in your new game, inspect it closely to spot any possible shipping damage. Check to ensure the graphics are in place, the monitor is not damaged and that the overall cabinet is in good condition. Open the rear access panel and inspect the inside of the game. Be sure no components or connectors have come loose. Proper connector fittings must be checked before game power is applied. Check all related connectors for good contact. Although disconnected are easily spotted, poor contacts are difficult to locate. The connectors should therefore be pushed in firmly and then loosened to spot poor connections. Check to ensure the fuses are intact. There are three fuses (not counting the monitor fuses). They are located on the power supply.

2. Important Notes

The following note is included in compliance with FCC rules:

WARNING: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. As temporarily permitted by regulations, it has not been tested for compliance with the limits for Class A computing devices pursuant to Subpart J of Part 15 FCC Rules, which are designed to provide reasonable protection against interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

3. Miscellaneous

NEVER remove circuit board connections while the power is on.

NEVER replace any components with anything other than exact replacement parts.

DO NOT replace fuses with anything other than proper value. A blown fuse indicates an overload condition within the game. Replacing the fuse with a higher value can cause damage to internal components, if an overload occurs.

CORRESPONDENCE regarding this game should be addressed to:

SEGA/Gremlin
8401 Aero Drive
San Diego, California 92123
Attn: Customer Service
(800) 854-1098

GAME CONCEPT

BORDERLINE is a one or two player game in which players attempt to destroy enemy refineries and energy plants. The player moves through four different sectors, constantly under attack by enemy tanks, missles, interceptors and drones.

Sector 1

The player is deep behind enemy lines, rolling his jeep down a corridor. He must dodge fire from interceptors, tanks and missles. Drones will attack unexpectedly. The object is to reach and destroy the energy plants at the end of the corridor.

Sector 2

Once through the corridor, the player enters a field that contains two sections of dense underbrush patrolled by drones. The drones will only enter the underbrush in one place, then follow in the path the player's jeep makes. The player must make a maze through the underbrush and proceed to the top and destroy the energy plants.

Sector 3

In this sector, enemy tanks come down from the top, near the refineries, and drones enter from the side. The player must outmanuever the enemy and destroy the refineries at the top.

Sector 4

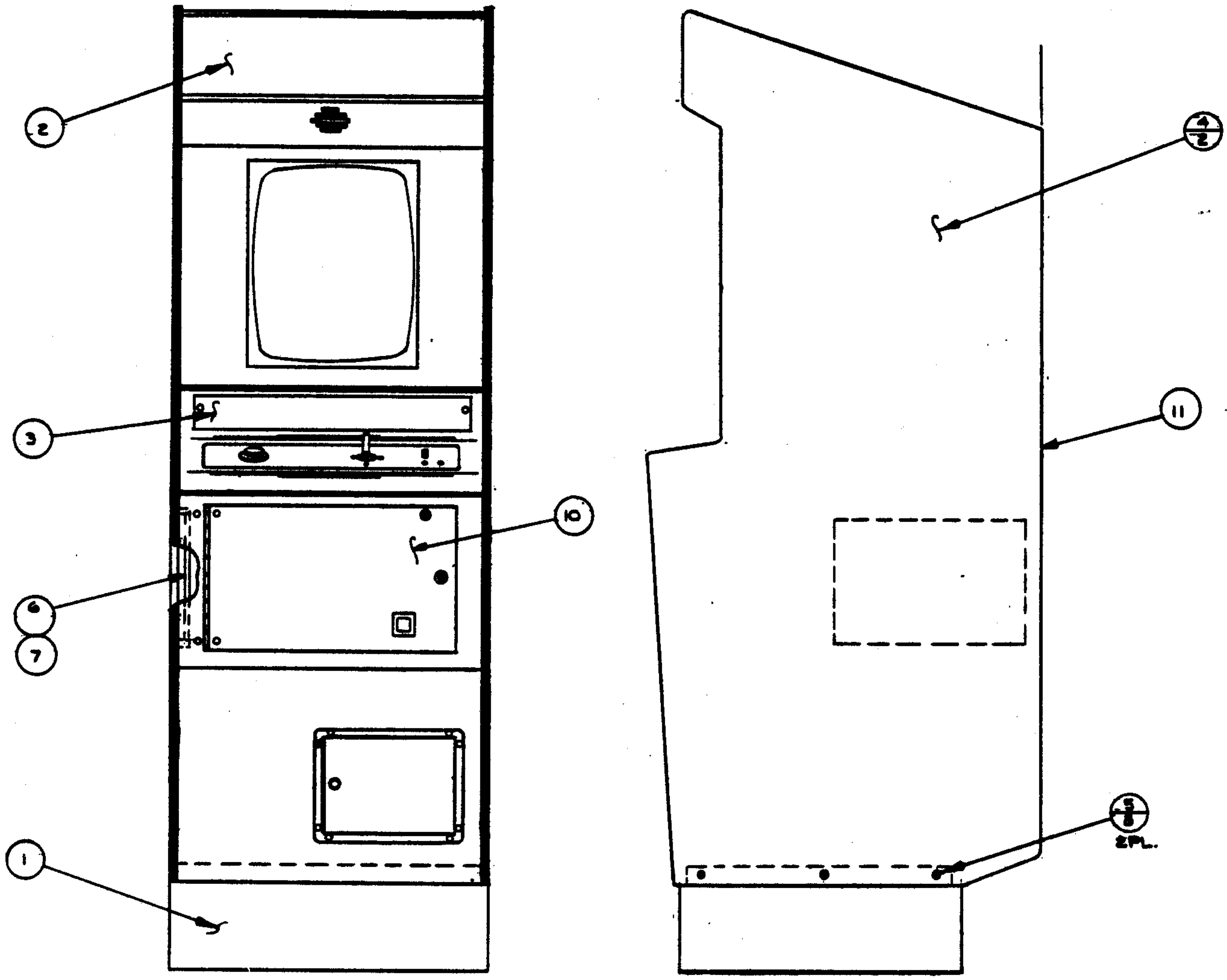
Again, there are two sections of underbrush, this time separated by walls. Drones enter from the sides. They will break the wall once, but not twice and will follow in the path made by the player's jeep. In the upper section of underbrush, is the energy plant. This time protected by revolving armament, in addition to tanks. The object is to destroy the energy base. Players alternate at the destruction of each jeep. The game ends when all jeeps are destroyed.

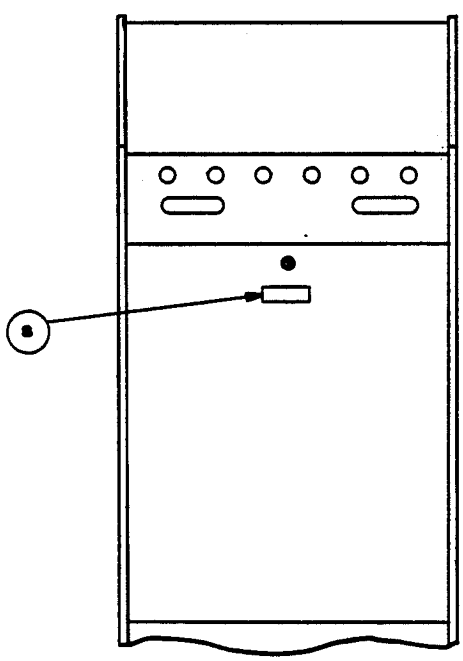
BORDERLINE OPTIONS SELECTION

OPTION SWITCH	1	2	3	4	5	6	7	8
3 Jeeps	On	Off	Off	X	X	X	X	X
4 Jeeps	Off	On	Off	X	X	X	X	X
5 Jeeps	Off	Off	On	X	X	X	X	X
Free Play	On	On	On	X	X	X	X	X
Bonus Jeep at 15,000 Points	X	X	X	Off	X	X	X	X
Bonus Jeep at 20,000 Points	X	X	X	On	X	X	X	X
Cocktail Table	X	X	X	X	Off	X	X	X
Upright	X	X	X	X	On	X	X	X

ITEM NO.	PART NO.	QTY REQD.	DESCRIPTION
1	252-0168	1	Game Base
2	253-0221	1	Logo Panel
3	253-0236	1	Game Instructions Panel
4	253-0237	11.8ft.	Woodgrain Vinyl Contact
5	281-0074-24	6	Flat Head Phillips Screw, #8-15 x 1.5
6	834-0058	1	Logic Board Assembly
7	834-0055	1	Sound Board Assembly
8	420-0568	1	FCC Decal
9	420-0613	1	Game Manual
10	420-0653	1	Front Graphic
11	734-0022	1	Upright Game Assembly

7 INDICATES RECOMMENDED SPARE PARTS--STOCK QUANTITY INDICATED TO SUPPORT 5 GAMES.

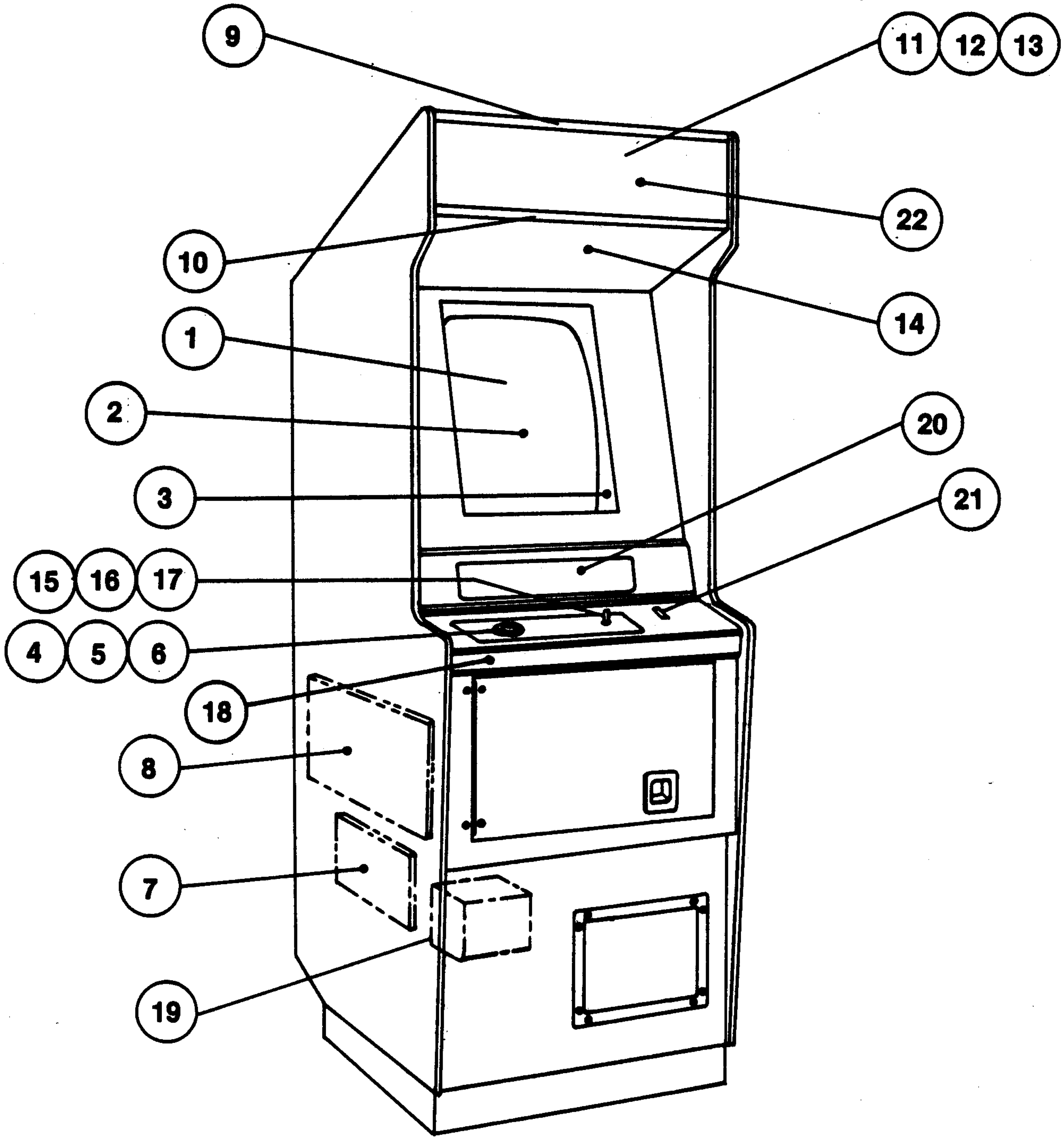




Top Assembly
700-0057

ITEM NO.	PART NO.	QTY REQD.	DESCRIPTION
1	601-0639	1	Smoke Plexi Mask
2	601-0640	1	Color Display Assembly, 19"
3	601-0641	1	TV Mask, 19"
4	240-0108	1	Red Push Button
5	240-0110	1	Button Housing
6	509-0114	1	Micro Type Switch
7	834-0055	1	Sound Board Assembly
8	834-0058	1	Logic Board Assembly
9	601-0642	1	Upper Ornament Frame
10	601-0643	1	Lower Ornament Frame
11	390-0031	1	15W Fluorescent Lamp
12	390-0076	1	FG-1P Starter
13	182-0006	1	100V Ballast Coil
14	130-0010	1	8 Ohm Speaker
15	109-0033	1	Knob
16	220-0146	1	Control Unit
17	509-0118	1	Micro Type Switch
18	220-0182	1	Control Panel
19	560-0036	1	100V-240V Transformer
20	253-0236	1	Game Instruction Panel
21	117-0037	1	Coin Entry Plate
22	253-0221	1	Logo Panel

Upright Game Assembly
734-0022



ITEM NO.	PART NO.	QTY REQD.	DESCRIPTION	REF DES.
1	150-0010	1	Electrolytic Capacitor, 100mf, 16V	C8
2				
3	151-0005	1	Ceramic Capacitor, 680pf, 50V	C12
4	151-0011	2	Ceramic Capacitor, .01mf, 50V	CP
[10] 5	151-0012	66	Ceramic Capacitor, 0.1mf, 50V	C1,C2,C4,C5, C7,C11,C13-72
6	151-0054	1	Ceramic Capacitor, .001uf	IC3, Pin 7 to Pin 9
7				
8	153-0001	4	Tantalum Capacitor, 10mf, 25V	C3,C6,C10, C1(Sub Board)
9	153-0002	1	Tantalum Capacitor, 1mf, 25V	C9
10				
11	170-0156	1	PC Board	
12				
13	211-0004	6	Test Point Connector Pin	TP1-TP6
14				
15	212-0004	2	4-Pin Male Connector	B11-B14, C15-C18

ITEM NO.	PART NO.	QTY REQD.	DESCRIPTION	REF DES.
16	212-0021	4	10-Pin Male Connector	A1-A10, D19-20, G53-G62, H63-H72
17	212-0031	2	12-Pin Male Connector	E29-E40, F41-F52
18				
19	213-0001	16	24-Pin Dual Inline Socket	XU1-XU8, XU26-XU33
20	213-0004	11	16-Pin Dual Inline Socket	XU14,XU15, XU49,XU69-XU76
21	213-0005	1	40-Pin Dual Inline Socket	XU16
22	213-0008	1	20-Pin Dual Inline Socket	XIC4
23				
[1] 24	230-0009	1	15.46848 MHZ Crystal	Y1
25				
26	312-0019	2	IC 74107	IC3-IC6
27				
28	314-0001	1	IC NE555	U18
[2] 29	314-0006	4	IC 7474	U36,U42.U43, U65
[1] 30	314-0009	3	IC 7400	U23,U62,IC1
[1] 31	314-0010	2	IC 7410	U39,U77
[2] 32	314-0012	4	IC 7408	U10,U11,U12, U24

ITEM NO.	PART NO.	QTY. REQ'D	DESCRIPTION	REF. DESG.
[2] 33	314-0015	5	IC 7404	U17, U25, U38, U68, IC3
[2] 34	314-0017	5	IC 74125	U51, U52, U54, U55, IC5
35	314-0020	1	IC 7430	U41
36	314-0022	1	IC 7486	U50
37	314-0029	2	IC 74157	U67, IC8
[2] 38	314-0035	6	IC 74151	U56-U61
39	314-0046	1	IC 74S04	U13
40	314-0047	2	IC 74174	U53, U66
[2] 41	314-0053	4	IC 74S175	U19-U22
42	314-0058	1	IC 74LS08	U35
43	314-0075	2	IC 74LS393	U37, U40
44	314-0077	1	IC 74LS166	U78
[2] 45	314-0092	2	IC 8216	U47, U48
[2] 46	314-0093	2	IC 74LS374	U63, U64
[1] 47	314-0104	3	IC 74LS138	U9, U34, IC8
[1] 48	314-0105	3	IC 74LS253	U44, U45, U46
49	316-1186	1	B/L E PROM	U1
	316-1185	1	B/L E PROM	U2
	316-1184	1	B/L E PROM	U3
	316-1183	1	B/L E PROM	U4
	316-1182	1	B/L E PROM	U5
	316-1181	1	B/L E PROM	U6
	316-1180	1	B/L E PROM	U7
	316-1179	1	B/L E PROM	U8
	316-1178	1	B/L E PROM	U26
	316-1177	1	B/L E PROM	U27
	316-1176	1	B/L E PROM	U28
	316-1175	1	B/L E PROM	U29

ITEM NO.	PART NO.	QTY. REQ'D	DESCRIPTION	REF. DESG.
	316-1174	1	B/L E PROM	U30
	316-1173	1	B/L E PROM	U31
	316-1172	1	B/L E PROM	U32
	316-1171	1	B/L E PROM	U33
[10] 50	315-0010	8	IC 4027	U69-U76
[1] 51	315-0031	1	IC Z80	U16
52	315-0089	1	IC PAZ02	IC4
53				
[1] 54	316-0042	1	IC PROM 32 X 8 SEQ	U15
[1] 55	316-0043	1	IC PROM 32 X 8 CTL	U14
[1] 56	316-0926	1	IC Color PROM PR23	U49
57	390-0003	1	Red LED	D2
58				
59	470-0102	15	Resistor, 1K,¼W 5%	R11,R12, R13, R19-R29, R34
60	470-0103	1	Resistor, 10K, ¼W,5%	R10
61	470-0220	3	Resistor, 22 ohm, ¼W 5%	R14, R15, R16
62	470-0221	1	Resistor, 220 ohm, ¼W, 5%	R11
63	470-0331	5	Resistor, 330 ohm ¼W, 5%	R3, R4, R6, R17, R18
64	470-0471	3	Resistor, 470 ohm ¼W, 5%	R8, R46, R47
65	470-0472	17	Resistor, 4.7K, ¼W, 5%	R9, R30-R45
66				
67	477-0002	2	Resistor Pack, 15 X 2.2K	RP1, RP2
68				
[2] 69	481-0006	3	Diode, IN914, MA150	D1, D3, D4

ITEM NO.	PART NO.	QTY. REQ'D	DESCRIPTION	REF. DESG.
70				
■1 71	482-0010	1	Transistor FPE8050	Q3
■2 72	482-0014	3	Transistor 2N4401	Q1, Q2, Q4
■1 73	482-0232	1	Transistor, FPN3644	Q5
74	510-0043	1	6-Position Dip Switch	SW1
75	630-0015	2	IC Type Heat Sink	Items 54, 55

ITEM NO.	PART NO.	QTY. REQD.	DESCRIPTION	REF. DESG.
1	150-0009	1	CAP, ELEC., 1MF, 50V	C45
2	150-0010	4	CAP, ELEC., 100MF, 16V	CP
3	150-0031	1	CAP, ELEC., 470MF, 10V	CP
4	150-0085	1	CAP, ELEC., 10MF, 16V	C76
5	150-0100	16	CAP, ELEC., 2.2MF, 50V	C3, C6, C8, C9, C11, C13-C15, C17, C25, C27, C51, C59, C62
6	151-0011	9	CAP, CER. .01 MF	C4, C5, C7, C19-C23, C65
7	151-0012	25	CAP, CER. .1MF	CP
8	151-0005	6	CAP, CER. 680 PF	C10, C12, C16, C18, C26, C28
9	152-0001	1	CAP, FILM .1MF	C50
10	152-0024	1	CAP, FILM .033MF	C1
11	152-0027	1	CAP, FILM .047MF	C58
12	152-0032	4	CAP, FILM, .022MF	C29, C36, C43, C60
13	152-0033	3	CAP FILM .01MF	C39, C48, C63
14	152-0037	1	CAP, FILM .068MF	C61
15	152-0051	1	CAP FILM .0033MF	C40
16	152-0117	1	CAP, FILM 6800PF	C44
17	153-0003	5	CAP, TANT, 2.2MF, 25V	C30, C31, C41, C42 C77
18	153-0016	1	CAP, TANT. .1MF, 35V	C72
19	153-0026	17	CAP, TANT. 22MF, 16V	CP
20	153-0028	2	CAP. TANT. .22MF, 35V	C32, C33
21	153-0031	2	CAP. TANT. 3.3MF, 25V	C54, C55

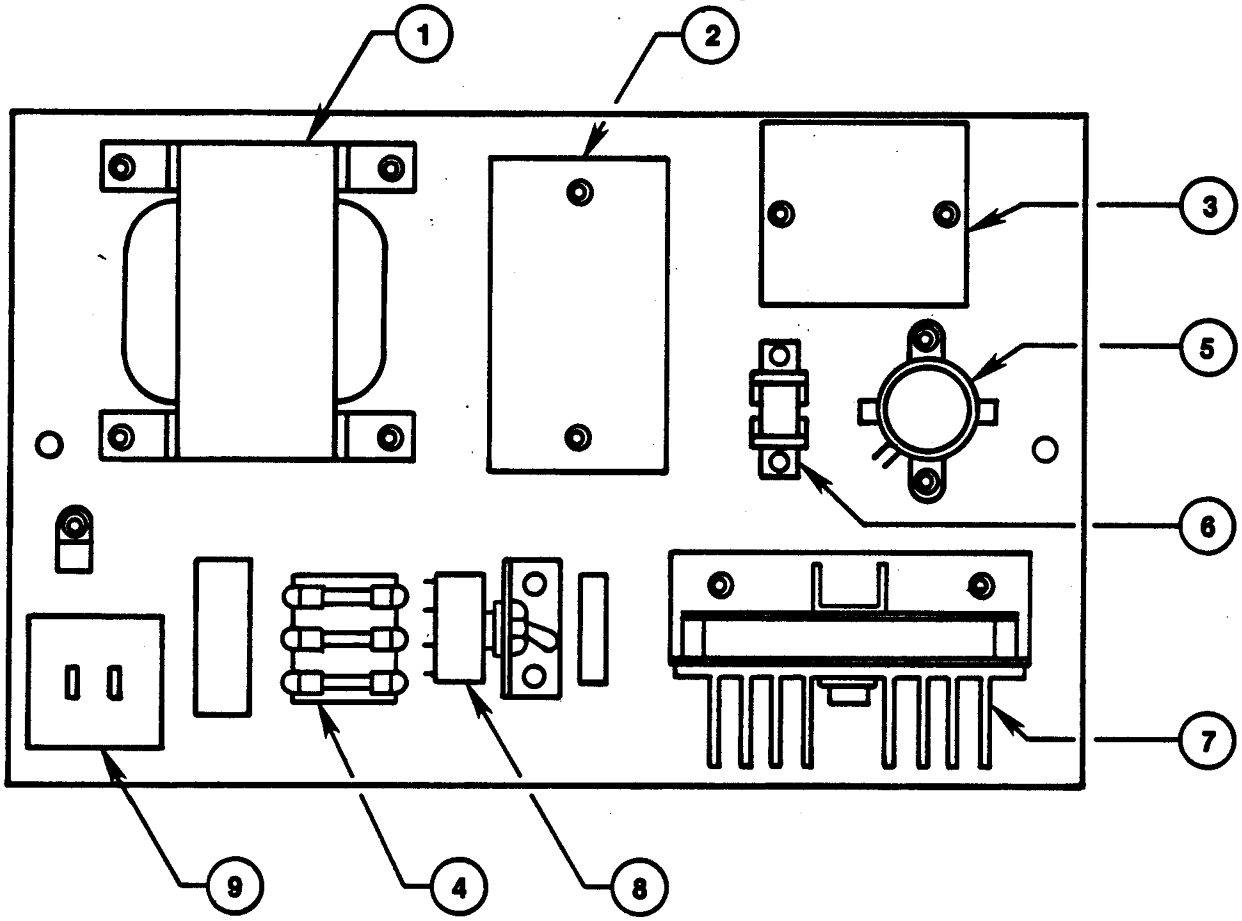
ITEM NO.	PART NO.	QTY. REQD.	DESCRIPTION	REF. DESG.
22	153-0048	1	CAP, TANT, 100MF, 16V	C24
23	153-0049	3	CAP, TANT. 47MF, 16V	C66, C67, C78
24	171-0123	1	PCB, OSCILLATOR	
[1] 25	312-0209	3	I.C. MB4391	IC4, IC5, IC20
[2] 26	313-0034	8	I.C. LM324	IC9, IC21-IC25, IC27, IC38
[2] 27	314-0001	16	I.C. NE555	IC1, IC6-IC8, IC10-IC19, IC28, IC31
28	314-0058	1	I.C. 74LS08	IC29
29	314-0062	2	I.C. 74LS74	IC30, IC32
[1] 30	314-0080	4	I.C. 74LS123	IC33-IC35, IC37
31	314-0146	1	I.C. SN7416	IC36
32				
33				
34	470-0102	17	RES. 1K, ¼W, 5%	R10, R20, R76, R109, R135, R136, R139, R140, R142, R145, R147, R148, R150-R152, R154, R156
35	470-0103	23	RES. 10K, ¼W, 5%	R9, R16, R19, R21-R25, R27-R31, R33, R34, R36, R43, R86, R110,R112, R119, R167, R168
36	470-0104	5	RES, 100K, ¼W, 5%	R53, R68, R88, R95, R100
37	470-0105	1	RES, 1M, ¼W, 5%	R40
38	470-0153	10	RES. 15K, ¼W, 5%	R45, R61, R69, R78, R85, R93, R101, R122, R131, R134

ITEM NO.	PART NO.	QTY. REQD.	DESCRIPTION	REF. DESG.
39	470-0154	1	RES. 150K, ¼W, 5%	R92
40	470-0221	1	RES. 220 OHM, ¼W,5%	R44
41	470-0222	1	RES. 2.2K, ¼W, 5%	R37
42	470-0223	16	RES. 22K, ¼W, 5%	R1-R8, R38, R41, R96, R99, R113, R114, R133, R137
43	470-0224	3	RES. 220K, ¼W, 5%	R54, R67, R132
44	470-0273	3	RES. 27K, ¼W, 5%	R98, R111, R163
45	470-0303	11	RES. 30K, ¼W, 5%	R11, R32, R35, R46, R62, R70 R79, R84, R126, R130, R169
46	470-0332	1	RES. 3.3K, ¼W, 5%	R18
47	470-0333	3	RES. 33K, ¼W,5%	R26, R102, R153
48	470-0363	1	RES. 36K, ¼W, 5%	R42
49	470-0393	1	RES. 39K, ¼W, 5%	R120
50	470-0471	6	RES. 470 OHM, ¼W, 5%	R89, R97, R103, R106, R159, R160
51	470-0473	9	RES. 47K, ¼W, 5%	R121, R138, R141, R143, R144, R146, R149, R155, R171
52	470-0474	15	RES. 470K, ¼W, 5%	R51, R75, R87, R90, R91, R94, R104, R105, R107, R108, R116, R161, R162, R164, R165,
53	470-0512	5	RES. 5.1K, ¼W, 5%	R14, R17, R52, R60, R77
54	470-0513	34	RES 51K, ¼W, 5%	R12, R13, R15, R39, R47-R50, R55-R58, R63-R66, R71-R74, R80-R83, R115, R117, R118, R123-R125, R129, R157, R158

ITEM NO.	PART NO.	QTY. REQD.	DESCRIPTION	REF. DESG.
55	470-0563	1	RES. 56K, ¼W, 5%	R127
56	470-0564	1	RES. 560K, ¼W, 5%	R59
57	470-0123	1	RES. 12K, ¼W, 5%	R166
58	475-0005	7	VAR, RES. 200K	VR1-VR4, VR6-VR8
59	475-0009	1	VAR. RES. 500K	VR5
2 60	481-0031	6	DIODE MA150	D1-D6
4 61	482-0227	16	TRANS. 2SC458	TR1-TR16

POWER SUPPLY ASSEMBLY

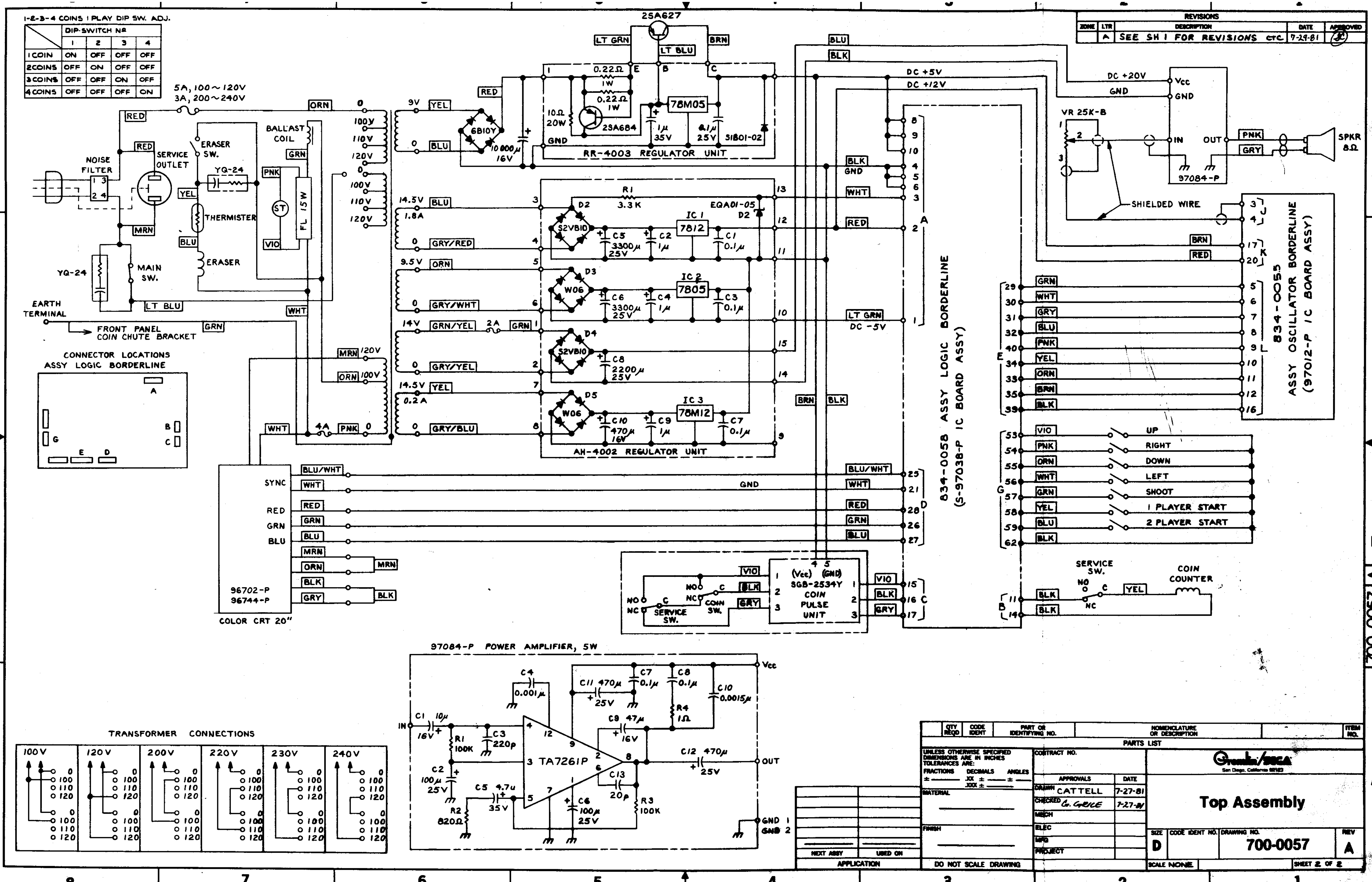
ITEM NO.	PART NO.	QTY REQD.	DESCRIPTION
1	560-0056	1	Power Transformer, 90-120V
2	601-0624	1	Voltage Regulator Assembly
3	110-0001	1	Power Amplifier, 5W
[3] 4	514-0032	1	2A Fuse
[3]	514-0034	2	5A Fuse
5	150-0061	1	Condenser, 10000uf, 16V
[1] 6	481-0049	1	Rectifier, Silicon Diode
7	601-0612	1	Regulator Unit
[1]	481-0065	1	Rectifier, Silicon Diode
[1]	481-0042	1	Rectifier, Silicon Diode
[1]	313-0012	1	IC uA 7805 UC
[1]	313-0014	1	IC uA 7812 UC
[1]	312-0070	1	IC uA 78M12 UC
8	509-0115	1	Toggle Switch
9	601-0484	1	AC Outlet

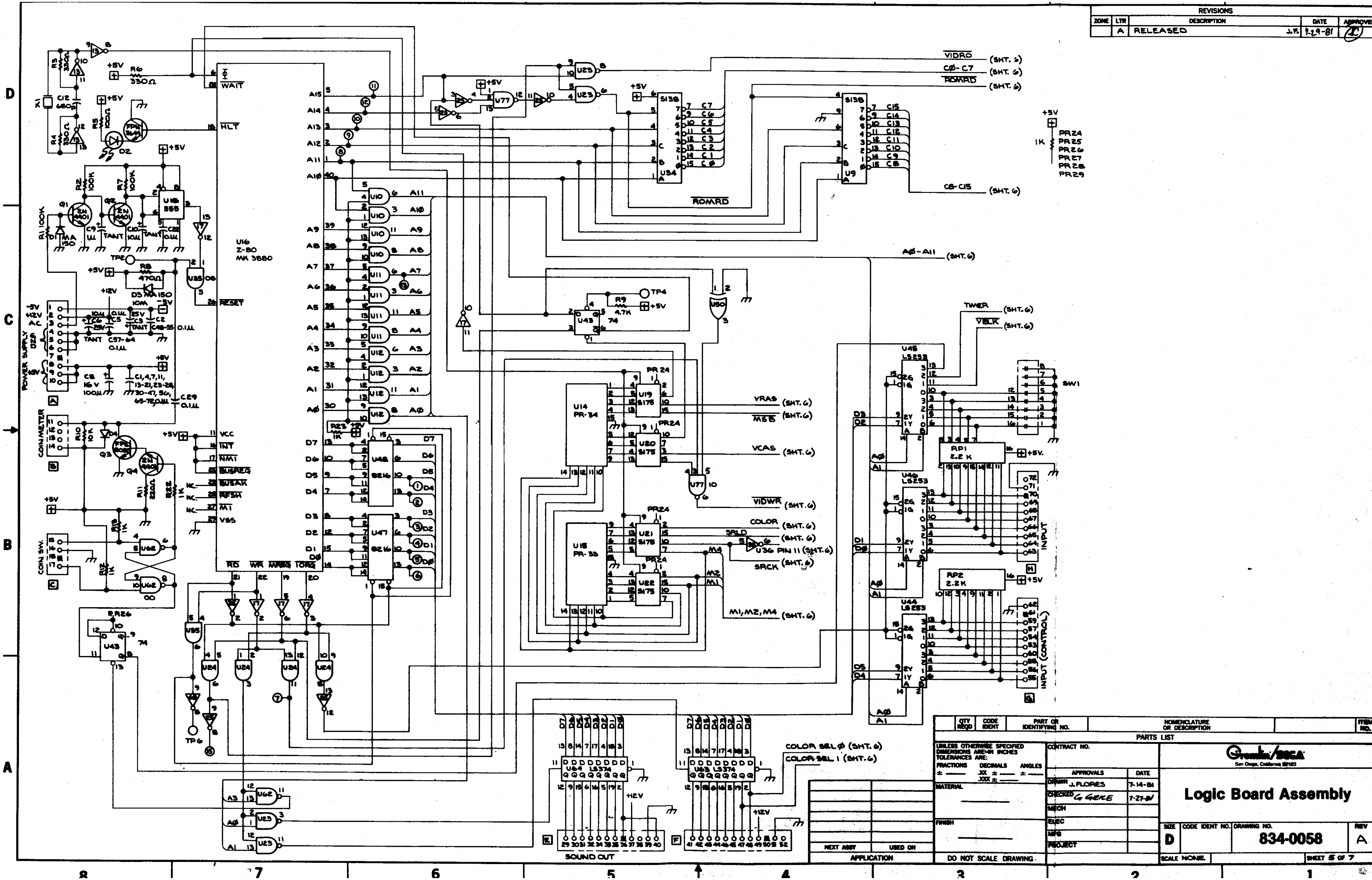


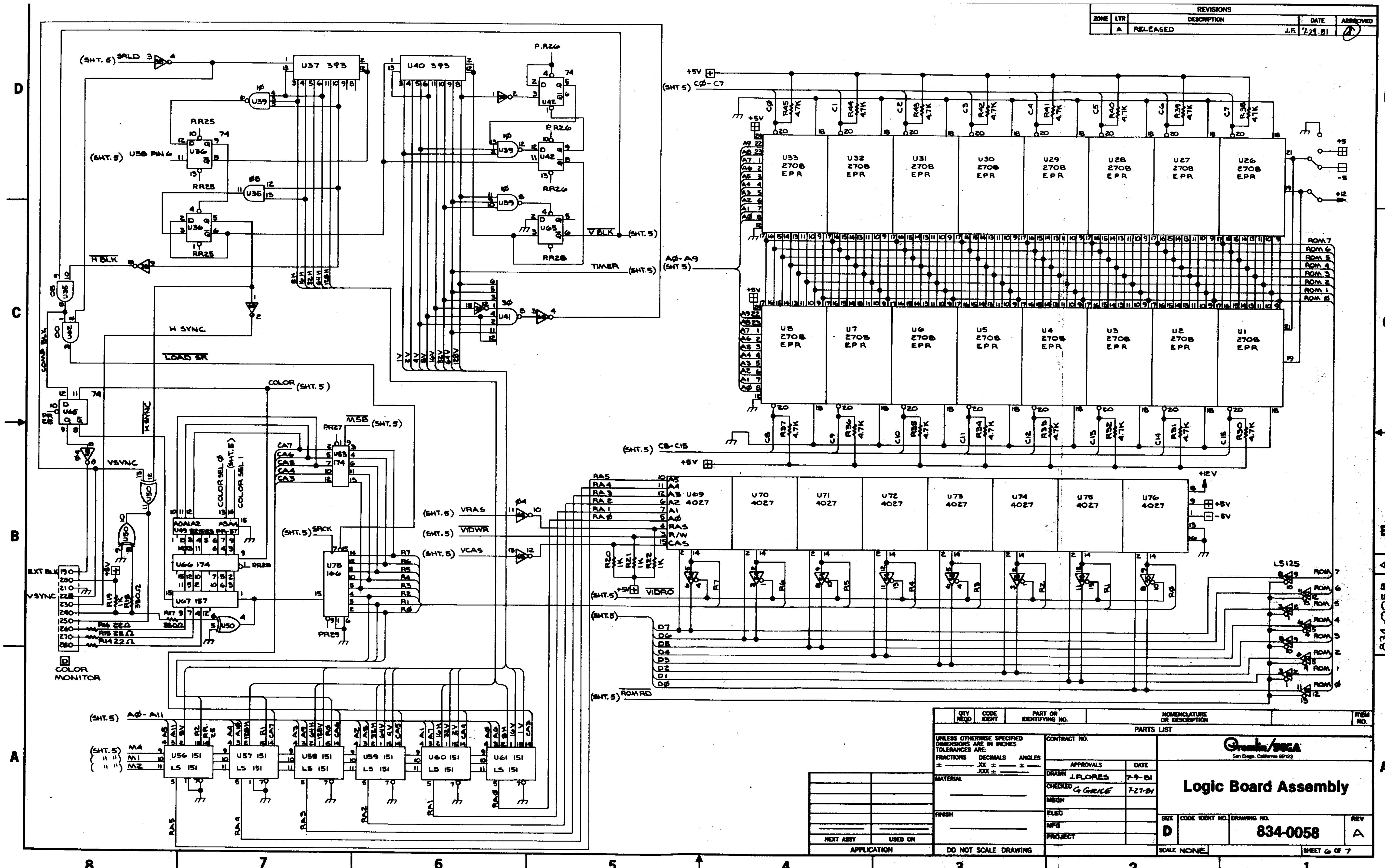
Power Supply

1-2-3-4 COINS 1 PLAY DIP SW. ADJ.

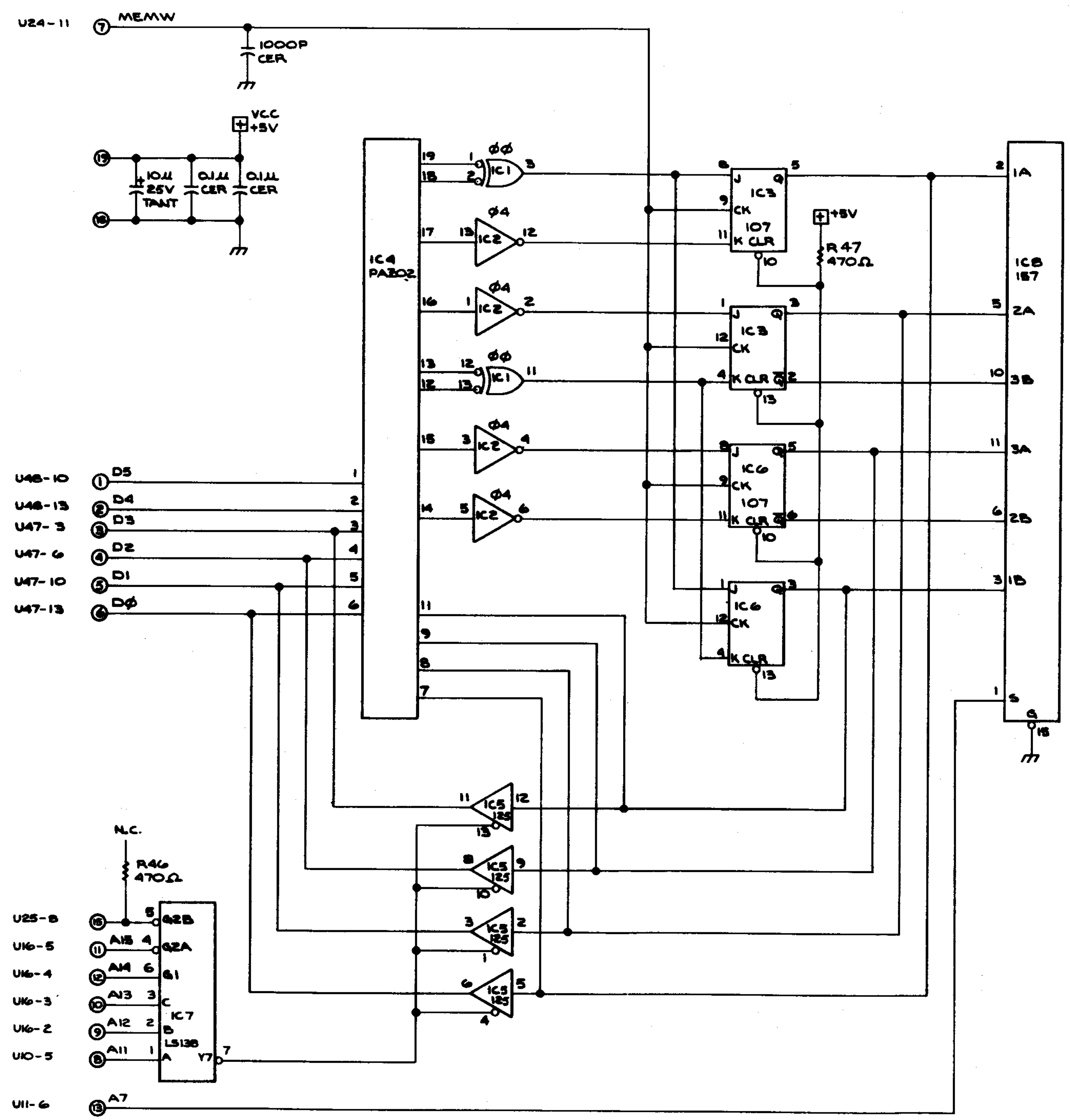
	DIP-SWITCH Nº 1	2	3	4
1 COIN	ON	OFF	OFF	OFF
2 COINS	OFF	ON	OFF	OFF
3 COINS	OFF	OFF	ON	OFF
4 COINS	OFF	OFF	OFF	ON




REVISIONS
ZONE LTR DESCRIPTION DATE APPROVED
A RELEASED J.F. 7-29-81
U16 Z-80 MK 3880
VIDRD (SHT. 6)
CØ-C7 (SHT. 6)
ROMRD (SHT. 6)
C8-C15 (SHT. 6)
AØ-A11 (SHT. 6)
TIMER (SHT. 6)
VBLK (SHT. 6)
VRAS (SHT. 6)
MSB (SHT. 6)
VCAS (SHT. 6)
VIDWR (SHT. 6)
COLOR (SHT. 6)
SRLD
U36 PIN 11 (SHT. 6)
SRCK (SHT. 6)
M1, M2, M4 (SHT. 6)
COLOR SEL Ø (SHT. 6)
COLOR SEL 1 (SHT. 6)
SW1
INPUT
INPUT (CONTROL)
SOUND OUT
POWER SUPPLY
COIN METER
COIN SW.
PARTS LIST
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:
CONTRACT NO.
DRAWN J. FLORES 7-14-81
CHECKED G. GERKE 7-27-81
Gremlin/SEGA San Diego, California 92123
Logic Board Assembly
SIZE D
DRAWING NO. 834-0058
REV A
SCALE NONE
SHEET 5 OF 7
DO NOT SCALE DRAWING
APPLICATION
NEXT ASSY
USED ON
834-0058


REVISIONS
ZONE LTR DESCRIPTION DATE APPROVED
A RELEASED J.F. 7-29-81
U37 393
U40 393
U33 2708 EPR
U32 2708 EPR
U31 2708 EPR
U30 2708 EPR
U29 2708 EPR
U28 2708 EPR
U27 2708 EPR
U26 2708 EPR
U8 2708 EPR
U7 2708 EPR
U6 2708 EPR
U5 2708 EPR
U4 2708 EPR
U3 2708 EPR
U2 2708 EPR
U1 2708 EPR
U69 4027
U70 4027
U71 4027
U72 4027
U73 4027
U74 4027
U75 4027
U76 4027
U56 151 LS 151
U57 151 LS 151
U58 151 LS 151
U59 151 LS 151
U60 151 LS 151
U61 151 LS 151
U66 174
U67 157
U53 174
U78 166
COLOR MONITOR
H SYNC
VSYNC
LOAD SR
COMP BLK
EXT BLK
H BLK
V BLK
TIMER
COLOR (SHT. 5)
MSB (SHT. 5)
VRAS
VIDWR
VCAS
SRCK
VIDRO
ROMRD
LS125
PARTS LIST
QTY REQD CODE IDENT PART OR IDENTIFYING NO. NOMENCLATURE OR DESCRIPTION ITEM NO.
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:
CONTRACT NO.
APPROVALS DATE
DRAWN J.FLORES 7-9-81
CHECKED G GARIGE 7-27-81
Gremlin/SEGA
San Diego, California 92123
Logic Board Assembly
SIZE D
DRAWING NO. 834-0058
REV A
SCALE NONE
SHEET 6 OF 7
NEXT ASSY USED ON
APPLICATION
DO NOT SCALE DRAWING

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	RELEASED J.F.	7-29-81	



QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	ITEM NO.

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN J. FLORES	7-16-81
CHECKED G. GRICE	7-27-81
MECH	
ELEC	
MFG	
PROJECT	

NEXT ASSY	USED ON
APPLICATION	

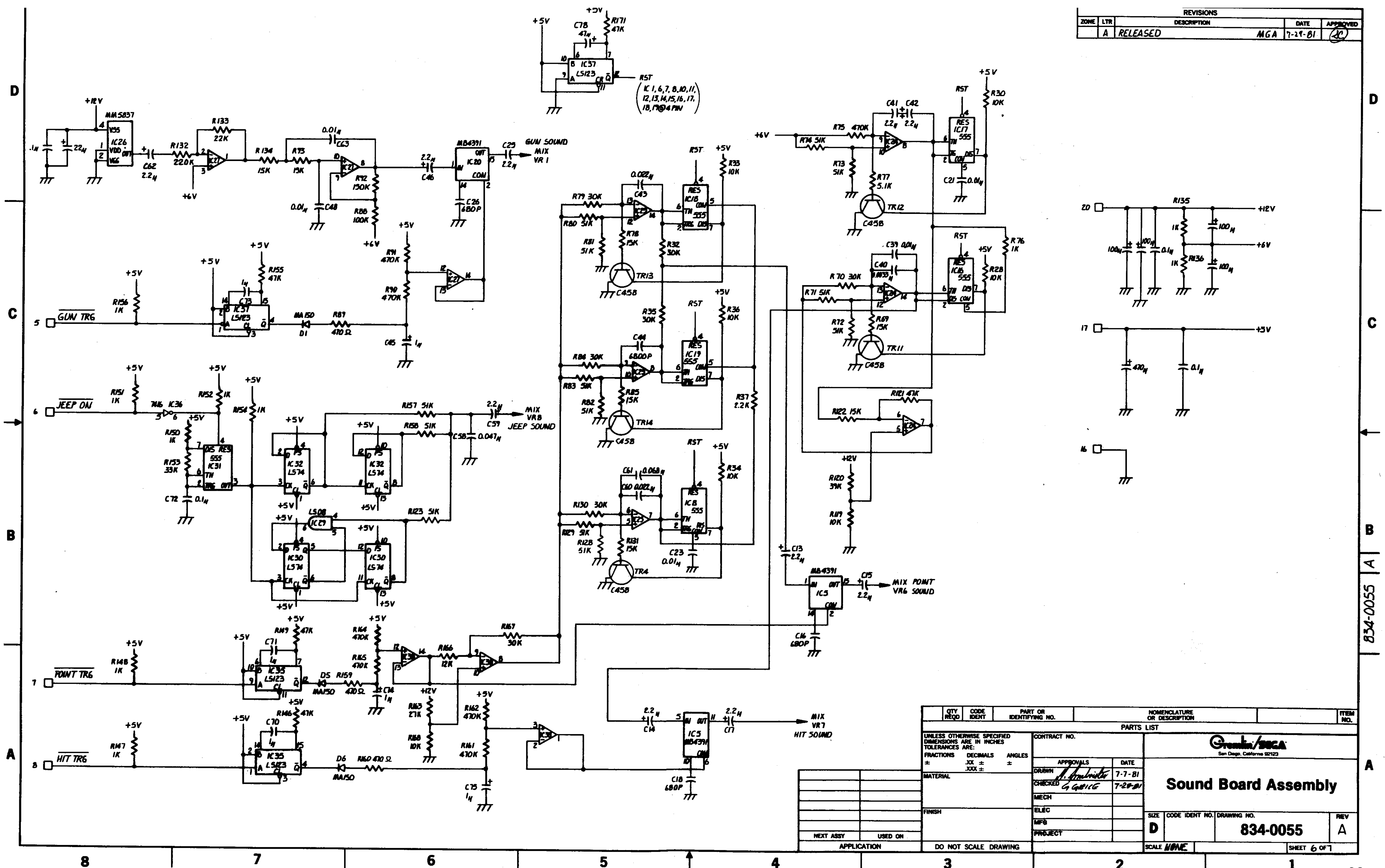
Gremlin/SEGA
San Diego, California 92123

Logic Board Assembly (Sub Board)

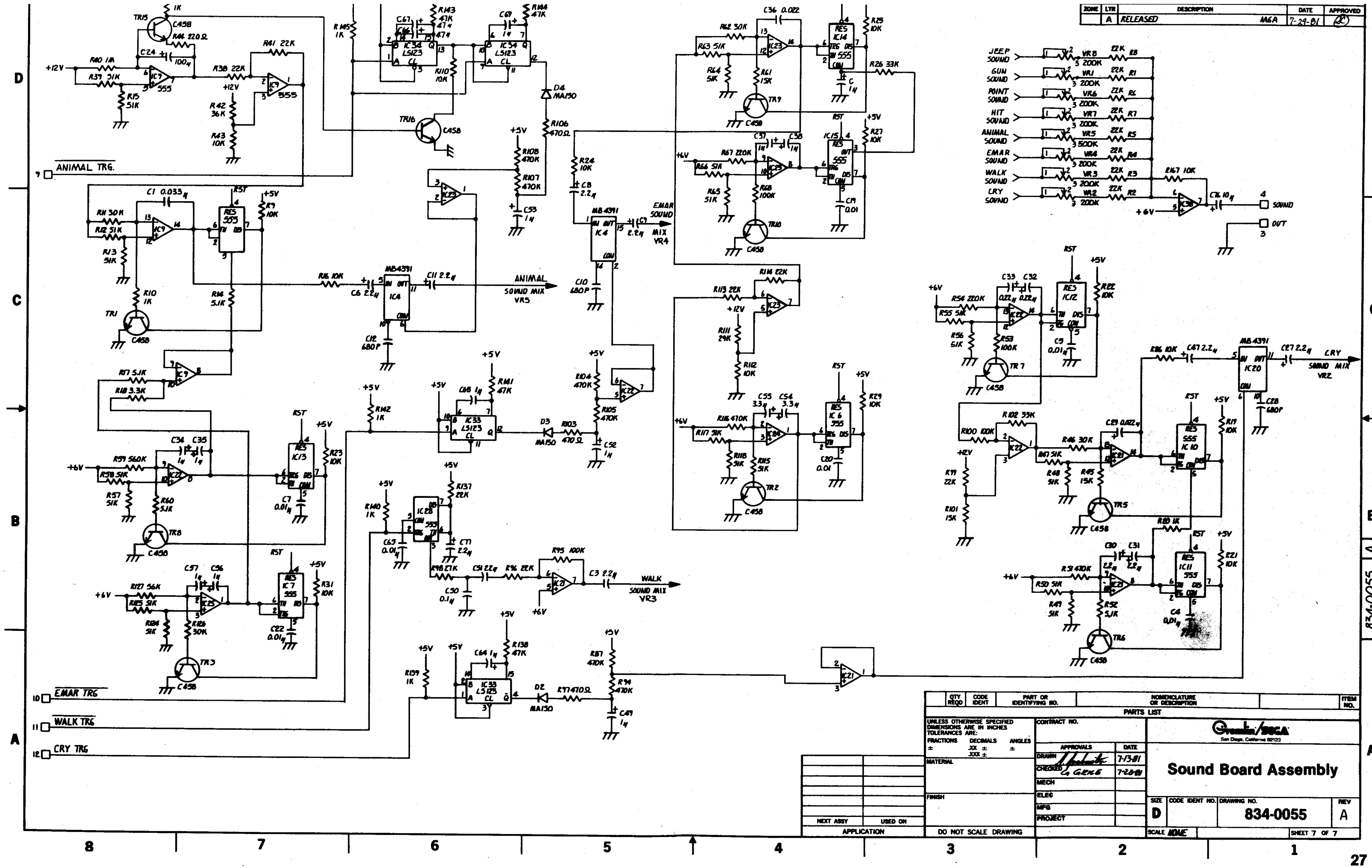
SIZE	CODE IDENT NO.	DRAWING NO.	REV
D		834-0058	A

SCALE ——— SHEET 7 OF 7

834-0058 A



REVISIONS
A RELEASED MGA 7-29-81
GUN SOUND MIX VR1
JEEP SOUND MIX VR8
MIX POINT VR6 SOUND
MIX VR7 HIT SOUND
GUN TRG
JEEP ON
POINT TRG
HIT TRG
Gremlin/SEGA
San Diego, California 92123
Sound Board Assembly
PARTS LIST
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:
DRAWN 7-7-81
CHECKED 7-29-81
SIZE D
DRAWING NO. 834-0055
REV A
SCALE NONE
SHEET 6 OF 7
DO NOT SCALE DRAWING
APPLICATION
834-0055 A


ANIMAL TRG.
EMAR TRG
WALK TRG
CRY TRG
ANIMAL SOUND MIX VR5
EMAR SOUND MIX VR4
WALK SOUND MIX VR3
CRY SOUND MIX VR2
JEEP SOUND
GUN SOUND
POINT SOUND
HIT SOUND
ANIMAL SOUND
EMAR SOUND
WALK SOUND
CRY SOUND
SOUND
OUT
ZONE LTR DESCRIPTION DATE APPROVED
A RELEASED MGA 7-29-81
PARTS LIST
QTY REQD
CODE IDENT
PART OR IDENTIFYING NO.
NOMENCLATURE OR DESCRIPTION
ITEM NO.
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:
FRACTIONS DECIMALS ANGLES
MATERIAL
FINISH
CONTRACT NO.
APPROVALS DATE
DRAWN 7-13-81
CHECKED G. GREKE 7-28-81
MECH
ELEC
MFG
PROJECT
NEXT ASSY USED ON
APPLICATION
DO NOT SCALE DRAWING
Gremlin/SEGA
San Diego, California 92123
Sound Board Assembly
SIZE D
CODE IDENT NO.
DRAWING NO. 834-0055
REV A
SCALE NONE
SHEET 7 OF 7
834-0055 A